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PSYCHOLOGICAL EFFECT OF THE INTAKE AND RETENTION  
OF UNPHYSIOLOGICALLY LARGE AMOUNTS OF WATER  
IN NORMAL INDIVIDUALS

Peter Karstens

Translation of "Über die Beeinflussung des psychischen Zustandes Normaler  
durch Aufnahme und Retention unphysiologisch grosser Wassermengen."  
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PSYCHOLOGICAL EFFECT OF THE INTAKE AND RETENTION  
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Peter Karstens

In connection with Büssow's inquiries into the effects of the water-tonephin-experiment (WTE) on manic-depressive states, we have conducted parallel experiments with normal subjects at the Alsterdorf Institutes. A description follows.

Years ago observations regarding the effects of drinking large amounts of liquids on the psyche of normal individuals were made. These have apparently received little attention.

Regnier drank 6000 cc of water daily over a period of 11 days and reported a generalized "out of sorts" feeling, particularly extreme fatigue.

Kunstmann drank an average of 10 liters/day of liquids during a period of 127 days. During the final weeks he had symptoms of mental and physical flaccidity and conspicuous fatigue. For example, it took an effort on his part not to fall asleep during the day while sitting at his desk. He described an agonizing indecisiveness and pointed out in particular that his condition must have been very similar to an incipient endogenous depression.

McQuarrie, who induced epileptic attacks in children by means of the WTE, noted psychic changes in his epileptics during the experiment. Considering the syndrome and the course of epilepsy it is not surprising that disturbed moods occur with cumulative attacks. However, in the more recent literature these psychological changes have obviously received varying degrees of attention, depending on the orientation of the author.

The mechanism of forced water intake and retention has been discussed in various papers.

Engel assumed that attacks could happen to anyone with very severe disturbances of water and salt balance due to increased swelling of the cell-colloid in the cerebral ganglia and in consequent increased permeability, versus a lowering of the stimulation threshold. Engel demonstrated this in dogs with tonephin. Rowntree demonstrated it simply by means of excessive water (as cited by Baumer).

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Engel pointed out that this permeability increase does not need to be a specific epileptic factor, and that it may be assumed that the stimulation threshold can be lowered in this way in other diseases that are accompanied by overstimulation of the nervous system, thus manifesting corresponding symptoms.

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Regarding Büssow's contribution to the subject, we refer to his work (Ref. 2).

In our first experiment, six healthy subjects drank 4 liters of liquid (weak herb tea) in the course of three morning hours. Their psychological condition was constantly checked during the day. We describe below a typical case from our records.

Subject H.O., age 26, student—an active, very alert and purposeful individual. The subject begins the experiment in a relaxed mood. His motor activity is lively.

10:00 a.m. Intake: 750 cc.

10:30 a.m. Intake: 1500 cc, secretion 370 cc. General condition of subject is good. His motor activity has slowed down. Subject's interest in his surroundings is decreasing, he has no inclination to entertain himself, his answers are short, and, in contrast to his initial state, are without spontaneous comments. His reactions are in part irritated.

11:00 a.m. Intake: 2000 cc, secretion 785 cc. Subject complains of slight headache in the frontal region and a feeling of fullness with eructation. He speaks of the desire for sleep. "I feel so despondent". Motor activity has slowed down considerably.

11:30 a.m. Intake: 2500 cc, secretion 1220 cc. Subject has slept for about 15 minutes and is again somewhat more lively (dance music on the radio, the visit of a friend).

12:00 noon. Intake: 3000 cc, secretion 1605 cc. Motor activity has now almost completely stopped. Further drinking produces nausea and retching. "This is all nonsense, what we are doing here. The weather outside is so beautiful, and I'm not able to enjoy it." Subject responds irritably to conversation. "Every thought is an effort, I don't want to think. I won't drink any more."

12:15 p.m. Secretion: 2050 cc. Subject complains of increasing dull pressure in his head. On attempting to drink further he becomes very nauseated and starts to vomit rather heavily. Subject lies exhausted and weak. Motor activity and drive are arrested.

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12:30 p.m. Secretion: 2410 cc. Subject attempts to drink again, but gives this up after renewed retching. He is again irritable and lacking in drive.

1:30 p.m. Secretion: 2595 cc. Subject eats lunch with moderate appetite after one hour's sleep. He is more communicative.

5:00 p.m. Secretion: 2970 cc. Subject still feels tired, but regains his customary level of mental activity.

During the night and following day no unusual occurrences were noted.

#### Summary of Drinking Experiment Results

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In one case a rise in the spirits of the subject was noted after the intake of 1500-2900 cc. In all cases during the maximum intake period a reduction in communication and motor activities were noted; a decrease in spontaneity and incomplete reactions to stimuli; decreased interest in surroundings.

The impression the experimental subjects gave at the height of the experiment could primarily be compared with the clinical picture of moderately retarded endogenous depression. Subjects noted a reduction in mental activity, interests and ability to concentrate. Three subjects evidenced a morose irritability.

Bodily complaints were made in varying degrees. These consisted of tension and a feeling of pressure in the head; in one case even severe pain localized in the frontal and temporal regions; and nausea, retching and vomiting.

Some psychological changes persisted after elimination of the fluids ingested. These, however, had disappeared by the following day at the latest. In one case euphoria still existed on the day following the experiments.

In our second experiment we conducted a WTE with seven healthy subjects. Janz's experimental conditions were followed. (Intake of 3-4 liters during two to three morning hours, subcutaneous injection of 1 cc of tonephin at the commencement of drinking; continuous checking of secretion; five to six hours after beginning, coffee and potassium acetate to promote urination.) Continuous conversation was conducted in order to prevent subjects from falling asleep spontaneously.

We describe next a typical case:

Subject M.E., age 26, student. Leptosome, somewhat unstable nervous system, five years ago cerebral concussion with no sequels. Very quiet, controlled individual. At the start of the experiment, subject is in well-balanced frame of mind.

9:30 a.m. Commencement of drinking.

9:40 a.m. Subject has become visibly pale.

10:00 a.m. Intake: 2000 cc, secretion zero. "I feel very relaxed and better than at the start of the experiment." No objective change noted in subject.

10:45 a.m. Intake: 3000 cc, secretion zero. Subject feels somewhat "drowsy". He is more comfortable sitting than lying down. A reduction in his retention powers is noted after reading technical literature. Subject reports flashing lights in front of his eyes. Face is very pale. "I have no desire to read any more."

11:00 a.m. "I feel inhibited. I brought some journals, but don't have the energy to start work."

11:30 a.m. Subject says his legs feel heavy and that he is feeling increasingly tired. He walks with slow, dragging steps. /234

12:00 noon. Secretion: 170 cc. Subject complains of dizziness, numbness and heaviness in his legs when he arises. The fatigue continues, but he is able to eat with good appetite.

1:00 p.m. Subject is overcome by fatigue, falls asleep, wakes quickly at each attempt to arouse him, but continues to fall asleep.

1:45 p.m. It takes effort now to awaken subject. Much time passes before he is again aware of the situation and able to master his senses. Still sleepy and lacking in drive. Unable to comprehend clearly what he reads.

2:20 p.m. Secretion: 520 cc. Subject still sleepy and thought processes are slow. Spirits are lower than at start of experiment. Attitude toward experiment has become negative. Subject doubts that injection is as harmless as he has been told.

3:45 p.m. Secretion: 1760 cc. Subject discusses scientific subjects with investigator. Ability to concentrate is increasing. No more reading difficulties.

4:00 p.m. Subject arises in order to help student with arithmetic problems. He notes that working with figures is more difficult than

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usual for him. Subject has to use extreme self-discipline in order to do problems correctly. "I felt slowed down during the whole lesson."

In the evening of the day after the WTE, subject experienced a feeling of depression. The future seemed black: "There is no point to my studying any further." Subject, who had had these moods before, although relatively seldom, had the impression that it was connected with the WTE. The following morning his depression had disappeared.

#### Summary of WTE Results

The initial symptom after the injection of tonephin is a paleness of the face. This was noted in all cases. With increasing fluid intake an edema occurred, especially in the face, in four out of seven cases. This disappeared at the latest with reestablished secretion.

Five out of seven subjects experienced during the first two hours of the experiment a rise in spirits which seemed to diminish in proportion to an increase in the rate at which the subjects drank. In all cases a more or less pronounced feeling of fatigue and inhibition of drive was evident at the height of retention. The effect was more noticeable the faster the fluids were drunk, and the later secretion began. In one case this lasted 36 hours. In three cases there was irritability and sensitivity to noise. In one case there was sensitivity to light. Two subjects could get no clear picture of what they were reading while another was aware of a limitation of his field of vision. In these symptoms we see evidence of a characteristic retinal edema, although they were also present in cases in which no facial edema was evident. In one case the sense of taste was gone, and the same person complained of feeling "as if my feet are cramped."

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For experimental objectivity we tested a number of the subjects before, during and after the experiment.

##### 1. Addition test.

At periods of 30 minutes, columns of the same degree of difficulty to be added were given the subjects. In each case, after 40 seconds, the subject was stopped and the number of figures added and mistakes were noted. No particular effect on this elementary task was seen.

##### 2. Wartegg and Rorschach tests.

No noticeable changes were determined. The tests are, however, somewhat unsuitable since they offer the same conditions each time. The Wartegg

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can not be modified at all and the Rorschach only to a small degree by means of the parallel series of Behn.<sup>1</sup>

### 3. Busemann enumeration test.

This is a test of mental agility in which the subject is directed to name all visible objects in the world. The observer writes along with the subject. Invisible, abstract and duplicate objects do not count. The experiment is ended if 60 seconds go by without a name, otherwise after 10 minutes. According to Busemann's tests on individuals with brain damage, intelligent individuals are able to list up to 250 items on the average in 10 minutes. A list of less than 80 names is unusual and below 50 is pathological.

Busemann also permitted several repeats of the test during the same period, since he had learned that only minimal differences result. According to his experience (we quote verbatim) reported cases of thought vacuum and poor performance in the enumeration have the following in common:

- (a) Deficient drive apparent through a lack of spontaneity; generally, also poverty of expression in which a mask-like emptiness of expression is noticeable.
- (b) Generalized slowness of psychic processes.
- (c) Lack of understanding of longer texts.

### Results

While a subject who hardly reacted to the WTE also showed no effects, we observed essential changes among others. Although subject M.Y. managed to continue for 10 minutes at the height of retention, he was not even able to list 7 items per minute. However, at the end of the WTE he was able to enumerate 31 objects per minute, which is what his intelligence level should be able to do.

### Summary

Elementary, preponderantly reproductive performance such as that checked in the addition test was not affected.

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<sup>1</sup>We are particularly grateful to Dr. H. Albrecht, Psychiatric Clinic, University of Hamburg-Eppendorf, for conducting and evaluating these tests.

As expected, the so-called personality tests showed no changes under WTE conditions.

A comparison of the simple drinking experiments with the results of the WTE shows that they both concern essentially the same phenomena. With WTE the external somatic changes are more obvious. The facial edema appears regularly; vasomotor reactions (paleness and subsequent redness) are only evident with WTE. Curiously, in contrast to this, it appears that the subjective malaise is less than in the simple drinking experiment. (This may possibly be because that due to tonephin the water is more quickly released to the tissues and does not remain in the digestive tract so long as in the simple drinking experiment.)

Psychologically, in almost all cases the same results were noted as in the simple drinking experiment, only they were much more pronounced.

(a) Initial rise in spirits after intake of about 1000 cc was noted in six out of seven cases, in contrast to one out of six in the simple drinking experiment.

(b) Sleepiness was evident in six out of seven cases; fatigue also occurred in five out of six cases in the drinking experiment.

(c) Above all must be noted the decrease in motor and intra-psychic activities, which is perceived as a decrease in drive. The decrease in motor drive was quite obvious to the observer.

Our tests allow a more detailed description of the psychic changes.

From a comparison of the addition test and the Busemann test it may be concluded that the relatively elementary mental functions tested by means of the addition test were not affected. These elementary functions would only be disturbed by a lessening of consciousness or dementia. In contrast, the Busemann test is chiefly concerned with spontaneity.

#### Summary

The intake of unphysiologically large amounts of water induces in healthy individuals in addition to varying degrees of bodily discomfort:

1. A desire for sleep.
2. A considerable slowing down and decrease in all motor functions, a decrease in awareness and ability to comprehend, as well as an effect on the ability to synthesize. (These phenomena may be freely reduced to a lack of spontaneity.)

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In contrast to the effect of WTE on temperament psychosis, the moods are relatively little influenced. There is an initial rise in spirits at the beginning of the experiment that more often changes to an irritable-morose mood at the height of the experiment or shortly after the beginning of renewed secretion.

These psychic phenomena are exaggerated and prolonged to an unusual degree by means of artificially created water retention (WTE). However, they do not differ in essence from the simple drinking experiments.

*author*

### Conclusions

It is possible to create experimental conditions in healthy individuals which have certain subjective as well as objective relations to symptoms of endogenous depression, namely the disturbance in drive.

However, it is not possible to produce the total picture of melancholia by this means.

Large amounts of water appear to have a certain sedative effect. These results are perhaps to be considered in evaluating pharmacological questions, particularly that of alcohol.

In the light of our experiments it is not unthinkable that the well-known tranquilizing and anesthetic effect of beer is due not only to the tempo of resorption of the alcohol or perhaps the accompanying chemicals, but also to the quantity of liquid ingested at the same time.

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